Data on Polychlorinated Biphenyls, Dieldrin, Lead, and Cadmium in Wisconsin and Upper Michigan Tributaries to Green Bay, July 1987 through April 1988

By
Leo B. House

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MANUEL LUJAN, JR., *SECRETARY*

GEOLOGICAL SURVEY

Dallas L. Peck, *Director*

For additional information
write to:

District Chief
U.S. Geological Survey
6417 Normandy Lane
Madison, Wisconsin 53719

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CONVERSION FACTORS AND ABBREVIATIONS

For the convenience of readers who may prefer to use metric (International Systm) units rather than the inch-pound units used in this report, values may be converted by using the following factors:

Multiply inch-pound unit	*By*	*To obtain SI unit*
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
ounce (oz)	28.35	gram (g)
pound (lb)	0.4536	kilogram (kg)
ton	907.2	kilogram (kg)
gallon (gal)	3.785	liter (L)
cubic inch (in^3)	16.39	milliliter (mL)

Other units of measurement used in this report are:

milligrams per liter (mg/L)
micrograms per liter (μg/L)
nanograms per liter (ng/L)
milligrams per kilogram (mg/kg)
micrograms per kilogram (μg/kg)
micrograms per gram (μg/L)

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ABSTRACT

A reconnaissance study was conducted of 22 streams tributary to Green Bay to determine whether any of the streams contribute toxic substances to the bay. This effort was part of a comprehensive investigation of Green Bay funded by the U.S. Environmental Protection Agency, Great Lakes National Program Office.

The U.S. Geological Survey sampled the bottom sediments and water columns of 11 streams tributary to western Green Bay for polychlorinated biphenyls, lead, and cadmium. Four of these streams also were sampled for dieldrin, a pesticide previously used in the watershed. An additional 11 streams tributary to eastern Green Bay were sampled for dieldrin in the bottom sediment and storm runoff. Samples were collected from July 1987 through April 1988.

Neither dieldrin nor cadmium was detected in any of the sampled tributaries. Detectable concentrations of polychlorinated biphenyls and lead were found at only three sites. Polychorinated biphenyls (0.10 microgram per gram) and lead (10 milligrams per kilogram) were found in the bottom sediment of Duck Creek, a western-shore tributary near the city of Green Bay. Lead (10 milligrams per kilogram) also was found in the bottom sediment of the Suamico River near the mouth, about 5 miles north of Duck Creek. Lead (4 micrograms per liter) was detected in a spring-runoff sample from the Fishdam River, a tributary from upper Michigan.

INTRODUCTION

Green Bay is an arm of Lake Michigan adjacent to Wisconsin and the Upper Penninsula of Michigan (fig. 1). During 1987, the U.S. Environmental Protection Agency (EPA) began a comprehensive study of polychlorinated biphenyls (PCBs), dieldrin, lead, and cadmium in Green Bay. It was necessary to identify all significant sources of these target contaminants to quantify loadings to the bay. A previous investigation by Marti (1984) indicated that all the primary tributaries to Green Bay transported PCBs into the bay. Marti found that the Fox, the Menominee, the Oconto, the Peshtigo, and the Escanaba Rivers contained detectable concentrations of PCBs in water, as follows:

Fox River	97.3 ng/L (nanograms per liter)
Menominee River	15.3 ng/L
Oconto River	6.7 ng/L
Peshtigo River	10.8 ng/L
Escanaba River	17.1 ng/L

During 1987 and 1988, the U.S. Geological Survey conducted a study of other important tributaries not investigated by Marti to determine whether they were significant sources of PCBs, dieldrin, lead, and cadmium. Laboratory analysis of samples was provided by the Wisconsin State Laboratory of Hygiene; funding was provided by the EPA.

Purpose and Scope

This report presents data collected by the U.S. Geological Survey during a water-sampling reconnaissance study of 22 tributaries to Green Bay (fig. 1). The EPA will use these data to determine whether any of these tributaries will be monitored during the comprehensive Green Bay Mass Balance Study of PCBs (U.S. Environmental Protection Agency, 1988).

Eleven of the tributaries studied are on the western shore of Green Bay and Michigan's Upper Penninsula; these were sampled for PCBs, lead, and

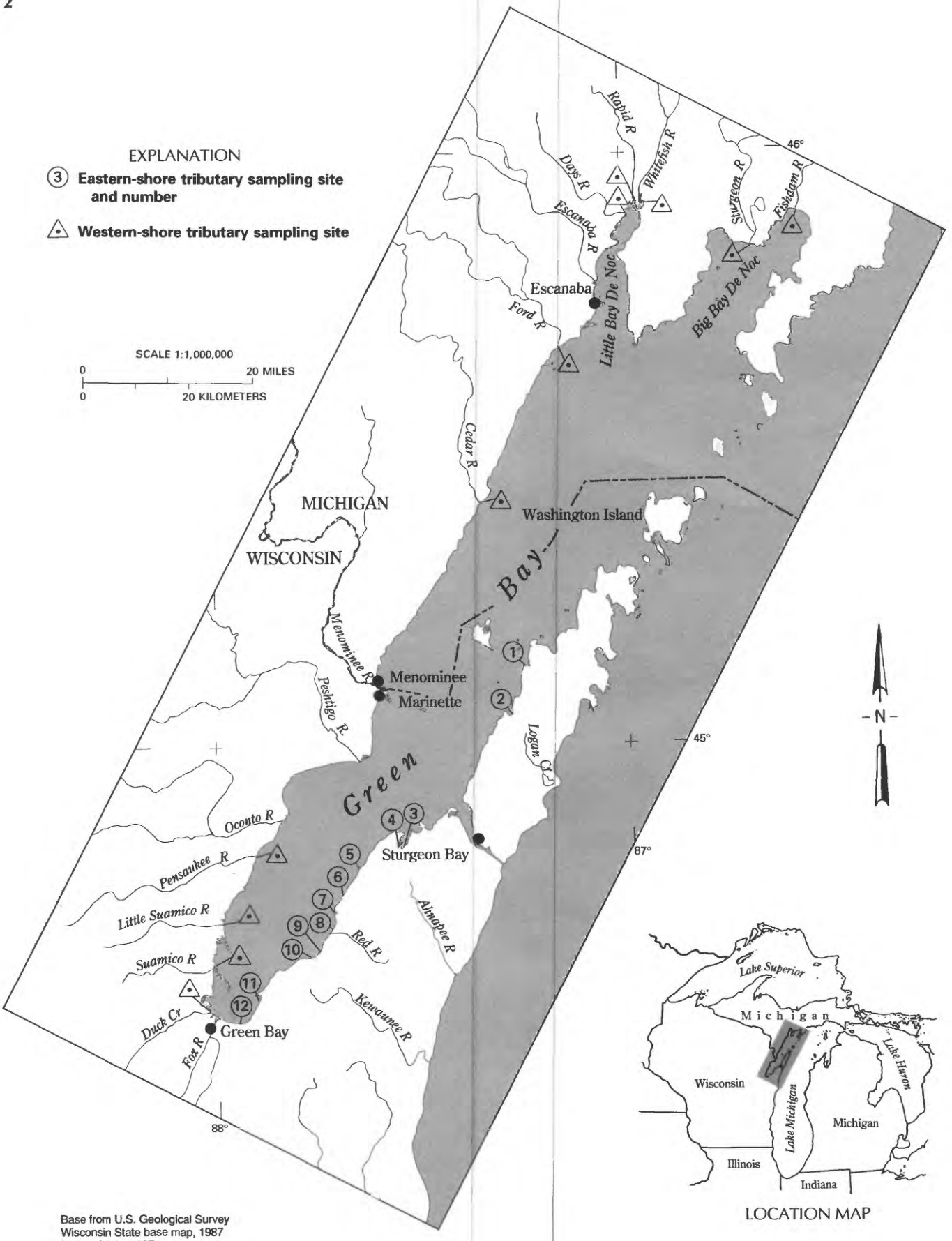

FIGURE 1. Map showing Green Bay tributary sampling-site locations.

cadmium. Four of these streams also were sampled for dieldrin because of past pesticide use in their watersheds. Bottom-material samples were collected from each stream near its mouth in July 1987. Water-column samples were collected from each stream during low-flow conditions in August 1987 and again during higher flow conditions in November 1987. Spring-runoff water samples were collected during April 1988.

Eleven other sampled tributaries are on the eastern shore of Green Bay, primarily in Brown and Door Counties, Wisconsin. These 11 streams were sampled for dieldrin because of the past history of this pesticide's use in orchards in the area. Bottom-sediment samples were collected from each stream near its mouth. Several storm-runoff water samples also were collected by local observers during the summer and fall of 1987.

Data Collection

Three samples of soft bottom sediment were collected from sites near the mouth of each river. Sample site "A" is upstream from any reverse flow from Green Bay. Site C is as close to the mouth as possible, and site B is between the other sites. Bottom-sediment samples for PCB and dieldrin analysis were stored in solvent-rinsed glass jars with Teflon[1] lids. Bottom-sediment samples for lead and cadmium analysis were stored in 250-milliliter plastic bottles supplied by the Wisconsin State Laboratory of Hygiene. All samples were collected using Teflon-coated or metal grab samplers or scoops. Sampling equipment was rinsed with solvent prior to sample collection and again between sampling sites. All samples were chilled immediately after collection.

Water-column samples were collected using depth-integrating samplers at three verticals in a cross section. A 20-L (liter) water sample for analysis of PCBs was composited in a stainless steel pressure canister. All water samples were collected using a solvent-rinsed glass bottle in a weighted bottle holding device suspended on a rope. Where stream depth was too shallow to use the sampler, an integrated sample was collected along a transverse stream section using the stainless-steel canister directly. Care was taken not to collect bottom sediment in the water-column samples. Two additional 1-L water samples were collected for dieldrin analysis. Water samples collected for analysis for PCBs and dieldrin were immediately chilled; water samples collected for lead and cadmium analysis were preserved using nitric acid in ampules and then chilled. All water samples were delivered to the lab within 48 hours of collection.

Water-column analysis for PCBs was done using methods developed by Marti (1984). All other analyses were performed using standard methods and detection limits employed by the Wisconsin State Laboratory of Hygiene.

POLYCHLORINATED BIPHENYLS, DIELDRIN, LEAD, AND CADMIUM IN WESTERN-SHORE TRIBUTARIES

Bottom Sediment

Bottom-sediment samples from 11 tributary streams on the western shore of Green Bay (fig. 1) were analyzed for PCBs, dieldrin, lead, and cadmium. These samples were collected during July 20–22, 1987. Low concentrations of PCBs [10 μg/gm (micrograms per gram)] and lead [10 mg/kg (milligrams per kilogram)] were found in the bottom sediment of Duck Creek near the mouth. A low (10 mg/kg) concentration of lead was detected in the bottom sediment of the most downstream site of the Suamico River. Only samples from Duck Creek, Suamico, Little Suamico, and Pensaukee River were analyzed for dieldrin. Complete results of these analyses are presented in table 1.

Water Column

Water-column samples from the 11 western-shore tributaries were collected August 10–12 and November 2–4, 1987, and April 11–13, 1988. Only samples from Duck Creek, the Suamico, and the Pensaukee Rivers were analyzed for dieldrin. Lead [4 μg/L (micrograms per liter)] was detected only in the spring-runoff (April) sample from the Fishdam River. Cadmium was not detected in any sample. Complete results of these analyses are presented in table 2.

DIELDRIN IN BOTTOM SEDIMENT AND STORM-RUNOFF, EASTERN-SHORE TRIBUTARIES

Bottom-material samples from 11 tributary streams on the eastern shore of Green Bay (fig. 1) were collected on July 23, 1987 for dieldrin analysis. Storm-runoff samples were collected by local observers at three sites and shipped to the State Laboratory of Hygiene. Runoff samples were collected August 15 and 18, November 17, and December 17, 1987. No detectable concentrations of dieldrin were found in any of these samples. The complete results of these analyses are presented in table 3.

[1]Use of trade names in this report is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.

SUMMARY

A low concentration of PCB (0.10 μg/g) and lead (10 mg/kg) was detected in the bottom sediment of Duck Creek near the mouth. This site is subject to reverse flow from Green Bay. A similar situation occurs at the most downstream site of the Suamico River, where a low concentration of lead (10 mg/kg) was detected in the bottom sediment. Lead (4 μg/L) was detected in the water-column sample from the Fishdam River, Michigan, site in the April 1988 spring-runoff sample. No other detectable concentration of PCB or lead was found in any water or sediment samples. Dieldrin and cadmium were not detected in any sample.

REFERENCES CITED

Marti, Edward, 1984, Polychlorinated biphenyls in 16 Lake Michigan tributaries: Madison, Wisconsin, University of Wisconsin Water Chemistry Department, M.S. Thesis, 247 p.

U.S. Environmental Protection Agency, 1988, Green Bay mass balance study plan: U.S. Environmental Protection Agency, Great Lakes National Program Office, Chicago, Illinois, 55 p.

Table 1.—*Analyses of bottom-sediment samples, western-shore tributaries*

[μg/g, micrograms per gram; mg/kg, milligrams per kilogram; —, no sample; <, less than]

River and site number	Date	PCB (μg/g)	Dieldrin (μg/g)	Lead (mg/kg)	Cadmium (mg/kg)
Fishdam River,	7/21/87				
Site A		<0.05	—	< 5	<1
Site B		< .05	—	< 5	<1
Site C		< .05	—	< 5	<1
Sturgeon River,	7/21/87				
Site A		< .05	—	< 5	<1
Site B		< .05	—	< 5	<1
Site C		< .05	—	< 5	<1
Whitefish River,	7/21/87				
Site A		< .05	—	< 5	<1
Site B		< .05	—	< 5	<1
Site C		< .05	—	< 5	<1
Rapid River,	7/21/87				
Site A		< .05	—	< 5	<1
Site B		< .05	—	< 5	<1
Site C		< .05	—	< 5	<1
Days River,	7/20/87				
Site A		< .05	—	< 5	<1
Site B		< .05	—	< 5	<1
Site C		< .05	—	< 5	<1
Ford River,	7/21/87				
Site A		< .05	—	< 5	<1
Site B		< .05	—	< 5	<1
Site C		< .05	—	< 5	<1
Cedar River,	7/21/87				
Site A		< .05	—	< 5	<1
Site B		< .05	—	< 5	<1
Site C		< .05	—	< 5	<1
Pensaukee River,	7/22/87				
Site A		< .05	<0.01	< 5	<1
Site B		< .05	< .01	< 5	<1
Site C		< .05	< .01	< 5	<1
Suamico River,	7/22/87				
Site A		< .05	< .01	< 5	<1
Site B		< .05	< .01	< 5	<1
Site C (near mouth)		< .05	< .01	10	<1
Little Suamico,	7/22/87				
Site A		< .05	< .01	< 5	<1
Site B		< .05	< .01	< 5	<1
Site C		< .05	< .01	< 5	<1
Duck Creek,	7/22/87				
Site A		< .05	< .01	< 5	<1
Site B		< .05	< .01	< 5	<1
Site C (near mouth)		.10	< .01	10	<1

Table 2.—*Analyses of water-column samples, western-shore tributaries*

[ft³/s, cubic feet per second; mg/L, milligrams per liter; ng/L, nanograms per liter; μg/L, micrograms per liter; —, no sample; <, less than]

River and date	Discharge (ft³/s)	Sediment (mg/L)	PCB (ng/L)	Dieldrin (μg/L)	Lead (μg/L)	Cadmium (μg/L)
Fishdam River,						
8/10/87	22.2	6.5	< 15	—	—	—
11/3/87	46.1	8.1	< 40	—	—	—
4/12/88	187	41.7	< 15	—	4	< 0.2
Sturgeon River,						
8/10/87	99.3	5.8	< 15	—	—	—
11/3/87	146	4.1	< 40	—	—	—
4/12/88	809	28.3	< 15	—	<3	< .2
Whitefish River,						
8/11/87	127	1.4	< 15	—	—	—
11/3/87	231	2.9	< 40	—	—	—
4/12/88	1,380	8.0	< 15	—	<3	< .2
Rapid River,						
8/11/87	66.2	1.5	< 15	—	—	—
11/3/87	90.8	2.2	< 40	—	—	—
4/13/88	418	16.2	< 15	—	<3	< .2
Days River,						
8/11/87	31.2	1.6	< 15	—	—	—
11/2/87	28.7	5.0	< 40	—	—	—
4/11/88	216	34.2	< 15	—	<3	< .2
Ford River,						
8/12/87	166	1.9	< 15	—	—	—
11/3/87	217	2.5	< 40	—	—	—
4/13/88	1,350	8.0	< 15	—	<3	< .2
Cedar River,						
8/12/87	73.5	1.6	< 15	—	—	—
11/4/87	156	4.9	< 40	—	—	—
4/11/88	1,670	12.8	< 15	—	<3	< .2
Pensaukee River,						
8/11/87	29.0	9.4	< 15	<0.05	—	—
11/2/87	11.0	19.6	< 40	< .05	—	—
4/11/88	107	8.3	< 15	< .05	<3	< .2
Suamico River,						
8/11/87	4.9	9.3	< 15	< .05	—	—
11/2/87	7.7	39.6	< 40	< .05	—	—
4/11/88	27.5	16.5	< 15	< .05	<3	< .2
Little Suamico,						
8/11/87	3.3	1.7	< 15	—	—	—
11/2/87	5.2	13.1	< 40	—	—	—
4/11/88	28.6	14.1	< 15	—	<3	< .3
Duck Creek,						
8/11/87	1.2	8.6	< 15	< .05	—	—
11/3/87	3.4	23.8	<200	< .05	—	—

No samples collected during spring runoff.

Table 3.—*Analyses of bottom-sediment samples and storm-runoff samples, eastern-shore tributaries*

[μg/g, micrograms per gram; μg/L, micrograms per liter; —, no sample; <, less than]

Sampling site name and number	Sample date	Bottom sediment dieldrin (μg/g)	Water column dieldrin (μg/L)
Fish Creek near State Highway 42 bridge, site number 1	7/23/87	<0.01	—
	11/17/87	—	<0.05
	12/17/87	—	< .05
Unnamed tributary. No samples collected. Site number 2			
Unnamed tributary to Little Sturgeon Bay near County C bridge, site number 3	7/23/87	< .01	—
Keyes Creek at County C bridge, site number 4	7/23/87	< .01	—
	8/18/87	—	< .05
Sugar Creek at Sugar Creek Park, site number 5	7/23/87	< .01	—
Unnamed tributary to Green Bay near Highway N, site number 6	7/23/87	< .01	—
Renard Creek at Shoemaker Road bridge, site number 7	7/23/87	< .01	—
Red River at State Highway 57, site number 8	7/23/87	< .01	—
	8/15/87	—	< .05
Kewaunee River at State Highway 57 near Dykesville, site number 9	7/23/87	< .01	—
Gilson Creek near State Highway 57, site number 10	7/23/87	< .01	—
Unnamed tributary to Green Bay at County A, site number 11	7/23/87	< .01	—
Unnamed Creek at County A near U. W. Green Bay campus, site number 12	7/23/87	< .01	—

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